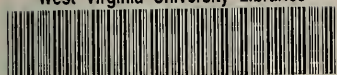


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TERIAN ORATION

1919

SIR ANTHONY BOWLBY

K.C.M.G., K.C.V.O., C.B.

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THE HUNTERIAN ORATION
ON
BRITISH MILITARY SURGERY IN
THE TIME OF HUNTER AND
IN THE GREAT WAR

DELIVERED BEFORE THE ROYAL COLLEGE OF SURGEONS
OF ENGLAND ON FEBRUARY 14TH, 1919, THE
ANNIVERSARY OF HUNTER'S BIRTH

BY
SIR ANTHONY BOWLBY, K.C.M.G., K.C.V.O., C.B.
TEMPORARY MAJOR-GENERAL, A.M.S.; CONSULTING SURGEON, BRITISH
ARMIES IN FRANCE; SURGEON-IN-ORDINARY TO H.M. THE KING;
SURGEON TO ST. BARTHOLOMEW'S HOSPITAL

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THE HUNTERIAN ORATION
ON
BRITISH MILITARY SURGERY IN THE
TIME OF HUNTER AND IN THE
GREAT WAR.

IN the year 1792 John Hunter finished the last of his works and dedicated it "To the King."

"May it please your Majesty.

"In the year 1761 I had the honour of being appointed by your Majesty a surgeon on the staff in the expedition against Belleisle.

"In the year 1790 your Majesty honoured me with one of the most important appointments in the Medical Department of the Army, in fulfilling the duties of which every exertion shall be called forth to render me deserving of the trust reposed in me and not unworthy of your Majesty's patronage.

"The first of these appointments gave me extensive opportunities of attending to gunshot wounds, of seeing the errors and defects in that branch of military surgery, and of studying to remove them. It drew my attention to inflammation in general, and enabled me to make observations which have formed the basis of the present treatise. That office

which I now hold has afforded me the means of extending my pursuits and of laying this work before the public."

This dedication is dated "Leicester Square, May 20th, 1792," although Guthrie states that "the work was not published until 1794"—*i. e.* the year after Hunter's death; but in spite of the fact that more than thirty years had passed since the period of Hunter's active service before he published his treatise, yet his interest in what he had seen at Belleisle remained so keen and his description of individual cases is so vivid that it might easily be supposed he was describing events of very recent occurrence. The whole "Treatise" is quite short, and occupies only 56 pages in the octavo edition of 1828.

In the "Roll of Commissioned Officers in the Medical Service of the British Army," by the late Colonel William Johnston, C.B., and published in 1917, Hunter's record reads as follows :

"John Hunter, Surgical Staff, Great Britain, 30th October, 1760. Half pay, 1764. Full pay, Assist. Surgeon General, 4th January, 1786. Surgeon General and Inspector of Regimental Hospitals, 17th March, 1790. Died October, 1793. Belleisle, 1761. Portugal, 1762."

An interesting fact which is not commonly known is supplied in this brief statement, for it appears that Hunter had acted as "Assistant Surgeon-General" for four years before his appointment as Surgeon-General.

At the time when Hunter went to Belleisle just 200 years had passed since Ambroise Paré had published his collected works, and it is not too much to say that military surgery had not advanced materially since his death in 1590. This lack of development was certainly not due to lack of opportunity, for the 200 years had been years of war, and firearms had quite replaced the arrows and bolts which in Paré's day were still frequent causes of injury, in spite of the then recently invented culverins and arquebuses.

A hundred years later than Paré, the great English surgeon, Wiseman, had written the most important treatise published since the time of the French master, and in the same year that saw the attack on Belleisle, Ranby, who had attended King George the Second in his Flanders campaigns, published a little book on gunshot wounds.

In France the successor to Paré was Le Dran, who in 1740 produced a considerable work on gunshot wounds based largely on Paré.

It would appear that the authors I have here enumerated were the only guides to whom Hunter could have turned for help and counsel when he set out to the wars. It is, however, noteworthy that he does not refer by name in his treatise to any surgical author at all, and that on the other hand he notes—

“Little has been written on the subject . . . and what has been written is so superficial that it deserves but little attention.”

It was, indeed, left for the following century to provide at its very commencement the men whose work, expanding and extending that of Hunter, laid the foundations of the military surgery of the nineteenth century, and the names of Larrey in France and Guthrie in England will for ever be associated in this connection.

HUNTER'S WAR EXPERIENCES.

It is of interest to glance for a moment at the wars of John Hunter's life-time.

Marlborough's campaigns had ended in 1711, before Hunter's birth, after his successful, but fruitless, attack at Arleux on the French line of trenches which lay across France from Namur to the sea at Montreuil, but Hunter was a youth of 17 years when, in the campaign of 1745, the battle of Fontenoy was fought. From that time until shortly before the attack on Belleisle there was a lull in the fighting and again, after 1763, there ensued a long period of peace, as far as England was concerned, except for the wars in America and India. It thus happened that the opportunity for further work in military surgery was lacking, and Hunter's careful notes of his cases made in 1761 remained without the additions which further wars would no doubt have provided.

His experience of military surgery in the field was thus limited to the Belleisle and Portuguese expeditions, and a brief description of these little-known naval and military operations in which

Hunter served will not, I think, be out of place. To Mr. A. D. Cary, the librarian of the War Office, I am much indebted for some of the following details.

BELLEISLE.

The first of these expeditionary forces consisted of about 10,000 troops under the command of General Hodgson, and was escorted by a powerful squadron of eight ships of the line and several frigates under Admiral Keppel. Its object was the capture of the island.

Belleisle is off the coast of Brittany and is about 12 miles in its greatest length and about 5 miles in its greatest width. It is surrounded by precipitous cliffs and forms a natural fortress. The chief town was on the northern edge of the island and was protected by a citadel, garrisoned by about 4000 men under the command of the Chevalier de Saint Croix.

According to the French historian, this garrison was very insufficient, and "Saint Croix, in order to deceive the British as to its numbers, mounted 50 volunteers on farm horses of the island, his efforts being admirably seconded by the female population. The women asked permission to help in this deception, and formed a squadron clothed in red capes. Those who had no horses mounted cows." (Waddington's 'La Guerre de Sept Ans.')

The first attack took place on April 8th, and after an initial success, resulted in the repulse of

the British with the loss of about 450 killed, wounded and prisoners. Of these there were rescued 75 British wounded, and there were also captured 54 wounded Frenchmen. All these appear to have been taken for treatment to the ships. A second attack on April 22nd was successful in occupying the island and driving the defenders into the citadel, where they withstood a siege for nearly two months, and finally surrendered on June 7th.

The French estimate of their own losses was 200 killed and 450 wounded, while Fortescue states that "the losses of the British throughout the whole of the operations were about 700 killed and wounded," and he adds: "Thus was Belleisle secured as a place of refreshment for the fleet." It was restored to France on the conclusion of peace in 1763.

PORTUGAL.

After the capture of Belleisle Hunter remained as one of its garrison for nearly a year, for it was not until the summer of 1762 that the opportunity came for some of the troops to embark on an expedition to Portugal, and there is no doubt that he accompanied this force.

The explanation of this event is thus described by Fortescue:

"The Spaniards on the pretext of Portuguese friendship with England, in April 1762, invaded Portugal, overran the country as far as the Douro from the North, and threw another force against

Almeida from the East. The injured kingdom appealed to England for help, and in May orders were sent to Belleisle for the departure of four regiments of infantry together with a detachment of the Sixteenth Light Dragoons to Portugal. Two more regiments were added from Ireland, bringing the total up to about 7000 men." (Fortescue's 'History of British Army,' vol. ii, p. 546.)

The force stood on the defensive to cover Lisbon and the line of the Tagus, but on August 27th Brigadier-General Burgoyne with 400 troops and the Grenadier company of the Buffs surprised and annihilated a regiment of Spanish infantry and took Valentia with very few casualties.

On October 4th another attack again took the enemy by surprise and resulted in the capture of six guns and other booty, with great loss to the Spaniards, but at the cost of only one man killed and eight wounded to the British. The results of this expedition are thus summed up in the 'Historical Records of the Third Foot' (The Buffs):

"This advantage being obtained at a critical moment was attended with important consequences; the enemy was disheartened, the season for military operations was far advanced, heavy rains fell, the roads were destroyed, and the Spaniards fell back to their own frontiers. Thus Portugal was saved by British valour and British skill."

Such, in brief, were the two expeditions in which Hunter saw active service, and it would appear that in Portugal there were very few casualties.

It is probable that in the Belleisle expedition the wounded numbered about 500, although by no means all of them could have been under Hunter's care. It is, however, likely that some of the patients were kept on the island until they had recovered, and so were under treatment for a long time.

It is also evident that a certain number of the French wounded were left to the care of the British surgeons, for it was provided by Article XI of the capitulation that "the officers and soldiers who are in hospital in the town and citadel shall be treated in the same manner as the garrison, and after their recovery shall be furnished with vessels to carry them to France."

HUNTER'S POSITION AT BELLEISLE.

The actual position occupied by Hunter during his stay on the island has hitherto been somewhat uncertain. I have, however, been fortunate enough to be supplied by Prof. F. Wood-Jones with a letter which shows that Hunter was not merely one of a surgical staff, but was in charge of the hospital, for in addition to his appointment as "staff surgeon," he is described as the "Deputy Purveyor," and in that capacity he was supplied by the Government with money to be spent on the hospitals by himself. The letter is dated April 12th, 1762, and was written only a short time before the forces at Belleisle were embarked for Portugal. It is as follows :

“ Belleisle, April 12th, 1762.

“ SIR,—The Hospital here being in want of money as appears by a letter sent to me this day by Mr. John Hunter, the Deputy Purveyor thereof, a copy of which is hereunto annexed, I have in compliance therewith issued my warrant to you of the same date as this letter for the sum of Two Hundred Pounds payable to the said Mr. John Hunter for the use of the said Hospitals, without deduction, but upon account, and do hereby direct and desire (as the Lords of the Treasury have not issued any money to you for the contingencies of this garrison) that you will pay the same out of the money which you have in your hands for the subsistence of the Troops here.

“ I am, Sir,

“ Your most humble servant,

“ H. A. LAMBART,

“ Brigadier-General Commanding-in-Chief
H.M. Forces in Belleisle.

“ To Charles Bembridge, Esq.,

“ Deputy Paymaster-General to Forces at
Belleisle.”

An examination I have made of the ‘ Journals of the House of Commons ’ has disclosed other payments as follows :

“ December 27th, 1761, to John Hunter, Esq., for the use of the Hospital £300 0. 0.”

“ March 10th, 1762, to John Hunter, Esq., for the use of the Hospital £100 0. 0.”

“April 12th, 1762, to John Hunter, Esq., for the use of the Hospital £200 0. 0.”

It seems, therefore, that Hunter was both the staff surgeon and also the chief administrator of the British Hospital at Belleisle. But, small though the number of wounded was in those days when compared with the tens of thousands of the present day, it is evident that at Belleisle it was sufficiently large to provide Hunter with food for much thought and study. He had no other duty except to care for his soldier patients, no other problems to solve save those of gunshot wounds, and we can picture him on the sea-girt cliffs pondering over the questions which presented themselves to his busy brain and shaping the newly-born thoughts of inflammation suggested by his first experience of war.

It appears to me very possible that we owe more to that period of contemplation on the remote island of Belleisle than has ever yet been guessed, and as we find Hunter himself saying of his experience of war thirty years later, “it drew my attention to inflammation in general,” we shall not be far wrong if we conclude that the germs of much of his most important later work were brought to life in the quietude which followed the siege and capture of the citadel.

THE MILITARY MEDICAL SERVICES IN THE EIGHTEENTH CENTURY.

At the time of Hunter's appointment as Surgeon-General in 1790 the Army had but one Physician-

General and one Surgeon-General, who were elected from the ranks of eminent civilian practitioners of the day, and it was the duty of the first to supply physicians to the Army and of the second to examine all candidates for appointments as surgeons. The Surgeon-General also recommended surgeons and "surgeons' mates" for appointments to hospitals and regiments.

In times of peace these duties were not arduous, for the standing Army was small, but when in 1793 we were obliged to raise ever-increasing armies for the war in Flanders it became impossible to provide the necessary surgical staffs. Hunter must have had many anxious hours at a time when his health was failing, for his own death occurred within six months of the declaration of war. I will therefore ask you to consider the condition of the Medical Services in the eighteenth century and the difficulties which were inherent in supplying the troops with efficient medical officers.

INADEQUATE PAY AND STATUS.

The Army Medical Service both before and during Hunter's lifetime left very much to be desired, and the pay and status were such that they offered no inducement to men of skill or learning.

John Woodall, writing in 1639 in his book called 'The Surgeon's Mate,' says: "And for the surgeons in his Land service he (The King) alloweth to the Surgeon-Major of the whole camp five shillings a day. Also his Majestie alloweth to each

Surgeon two shillings and sixpence a day, which is three pounds and fifteen shillings a month, and to each Mate three pounds a month. . . . And further His Highness hath referred to the ancient Masters and Governors of our Society (*i. e.* the company of Barber-Surgeons) the pressing of all Surgeons and Surgeon's Mates or servants to Surgeons and Barbers." It is therefore evident that, as the pay was not a sufficient inducement, surgeons were "pressed" or forced, as seamen were forced by press-gangs, to join the service when war called for surgical help.

More than a hundred years later, and consequently after Hunter's experience at Belleisle, the inducements to serve were still not improved, for in 1787, only three years before Hunter's appointment as Surgeon-General, Robert Hamilton wrote: "Each regiment is allowed a Surgeon, as he is termed, and a Surgeon's Mate. Their business is to attend to the diseases of the men at all times whenever it is judged necessary. For this service the surgeon is allowed four shillings a day; the mate three and sixpence. But out of this are levied from them considerable duties; from the surgeon a shilling, and from the mate sixpence a day. This makes their subsistence equal, so that each is limited to a guinea a week, and on this they must subsist as well as they can."

The pay of John Hunter as staff surgeon is uncertain, but was probably ten shillings a day, and he also had another ten shillings as "Deputy-

Purveyor.” He joined the Army for the Belleisle Expedition chiefly in order to obtain a change of duties and surroundings after illness and overwork in London; when the war came to an end he returned to his studious life, and started practice in Golden Square at the age of 35.

It is evident that one of the chief causes of inefficiency in the medical service in the eighteenth century was the custom of employing ignorant and often uneducated men as “surgeon’s mates.”

The mate was the assistant of the surgeon and was usually unqualified, except that he might have been a surgeon’s apprentice in civil practice. Some few, it is true, were well-educated men who had attended lectures on anatomy, surgery, and medicine, but all of them were only “warrant officers” and did not hold commissions.

So long as there was no war to make demands for an increase of the staff of surgeons the evil was not very great, but in 1793, on the outbreak of war with France, “an increase of the hospital establishments of the Army became necessary, and, the pay of ‘hospital’ mates being higher, many ‘regimental mates’ transferred to the hospitals as ‘hospital mates.’ An increase in the number of surgeons led to the promotion of many regimental mates, and many also purchased commissions.” (Colonel Johnstone.)

The result of this was, first, that many of the men who now held commissions as surgeons were very ignorant fellows; and second, that the places

of the promoted mates were filled by men of low class, most of whom had no surgical knowledge at all, but were yet in control of the treatment of hundreds of men. For example, we read that on one occasion "five hundred invalids were embarked from Arnheim in barges under the care of a single surgeon's mate without sufficient provisions and without even straw to lie on." (Fortescue: 'British Campaigns in Flanders.')

BAD STATE OF MEDICAL SERVICE IN 1793-4.

But not only was the^e pay and status of the surgeons bad, the administration of all the Army was on a thoroughly unsound footing, for after Marlborough's time its efficiency, or the reverse, depended on the Minister in power in England for the time being.

Military history shows that in the campaigns of 1793 and 1794, just when Hunter's work was published, mismanagement and incapacity in the Government had reduced the whole Army to a state of inefficiency and chaos. Thus, Fortescue writes: "The men were imperfectly disciplined, there were no efficient company officers to look after them; no efficient colonels to look after the company officers; no generals to look after the colonels. . . . No effort was made to clothe recruits, who received a linen jacket and trousers, and many were sent on active service in this dress, without waistcoat, drawers, or stockings" (Fortescue, p. 372). So bad indeed was the supply of Army clothing that great-

coats were supplied to some regiments by public subscription.

The medical service was such as might be expected when the Army, as a whole, was in this condition, and the state of affairs in July, 1794, is described as follows :

“ But the very worst department of all was that of the hospitals wherein the abuses were so terrible that men hardly liked to speak of them. . . . Some kind of a medical staff was improvised out of drunken apothecaries, broken-down practitioners, and rogues of every description, who were provided under some cheap contract ; the charges of respectable members of the profession being deemed exorbitant. . . . ‘ The dreadful mismanagement of the hospitals is beyond description,’ wrote General Craig.” (Fortescue).

It will be noticed that this explanation of the rotten state of the medical service was the unwillingness to spend the money necessary for efficiency, and it requires but little study to realise that gross maladministration and peculation of public money were at the root of most of the troubles in all departments of the Army.

Hunter had been appointed in 1790 to be “ Inspector-General of Hospitals and Surgeon-General in the Army,” but he had died on October 16th, 1793, before the breakdown I have mentioned above. As far as I can ascertain, however, his authority did not in any case extend

overseas, and, even had it done so, it is quite certain that he would have been powerless to check abuses which originated in maladministration of Ministers in England, and which resulted ultimately in the armies being so starved of supplies of food and clothing that by November, 1794, there were 11,000 sick out of a total force of infantry of 21,000. It is not too much to say that the collapse and defeat of the British forces in Flanders at that time were brought about more by the want of ordinary care for our troops than by anything else. Even the best medical service is powerless when no provision is made for the ordinary necessities of life, especially if the combatant officers are as ignorant and inefficient as were very many of them at that time.

A MODERN CONTRAST.

In the present war the splendid health of our armies has not been due solely to the work of the medical service during the war, good though that has been. It has also been due to the instruction of the combatant officers before the war in the value of good hygiene and of the proper care of the men in camps and billets. This, in its turn, has been supported by the abundance and excellence of the supplies of food and clothing which have everywhere followed our troops throughout the campaign in a never-failing stream; while the supervision and supply of drinking-water, the precautions taken to destroy flies and to burn refuse, to inspect

and cleanse billets, etc., have all contributed to save life and to avoid sickness.

The result is that the invaliding rate from preventable disease in the fourth and fifth years of the present war has been no more than the same rate in times of peace, and while the war in Flanders at the end of Hunter's life failed largely because of the immense loss to the forces caused by the sickness of the whole Army, it is not too much to say that in the present war much of the efficiency and fighting power of the British troops has resulted from the good health and the consequent high spirits of all ranks.

The records of many sieges have proved that sick and half-starved men may hold on to a defensive position and fight well to the last, but it is only robust, vigorous, and thoroughly healthy troops who are capable of enduring the immense strain of pressing home for many weeks in rapidly succeeding battles such a strenuous and victorious offensive as that initiated by the British Army on the ever-memorable day of August 8th, 1918, and consummated in the armistice of November 11th.

HUNTER'S WRITINGS ON GUNSHOT WOUNDS.

It is very difficult to properly appreciate the value of Hunter's writings on gunshot wounds at the time of their publication, but their interest for surgeons can be better estimated if it is remembered that no one had previously written much about these injuries for many years, and that Hunter's

great reputation and his position as Surgeon-General compelled the attention of everyone connected with the medical service.

Superstition and ignorance had united to create the belief that there was something about a gunshot wound which rendered it quite unlike any other, and, to use Hunter's own words, "they have been considered apart from other wounds and are now become almost a distinct branch of surgery." He then proceeds to point out that they are essentially "contused wounds," although they have certain peculiarities due to the passage of foreign bodies into the tissues, and that they should be treated on ordinary commonsense principles.

Hunter was the first to clearly appreciate and teach that in the gunshot wounds of his time "a part of the solids surrounding a wound is deadened . . . and is afterwards thrown off as a slough, which prevents such wounds healing by the first intention." He pointed out how the separation of a slough might open a part of a large artery or a portion of intestine.

He realised that "the greater the velocity of the bullet the cleaner it wounds the (soft) parts."

He noticed that "when the velocity is small the direction of the wound produced by the ball will, in common, not be so straight, therefore its direction not so readily ascertained, arising from the easy turn of the ball."

He taught the much-needed lesson of not interfering with any wound unless a definite object was to be gained. He wrote: "We must see plainly

something to be done for the relief of the patient by this opening (of the wound) which cannot be procured without it," and he was able by his influence and reputation to alter the practice of the routine opening up of every bullet wound, regardless of any indication for so doing, which was a universal custom before he challenged it.

His description of peritonitis following intestinal injury and of infection of a hæmothorax caused by a wound of the lung are masterpieces of observation and perception, and his opinion that a hæmothorax might be advantageously treated by emptying the blood from the pleura coincides with the practice of the present day.

HUNTER'S VIEWS ON PRIMARY AND SECONDARY AMPUTATIONS.

It is evident that Hunter felt, as all surgeons have felt, the difficulty of deciding the best time for the removal of a hopelessly smashed limb, and it seems also clear that his experience of "primary" amputations, with the primitive methods of that day, had been bad.

The consequence was that he advocated delay, more especially when the lower extremity was concerned, but it is not clear what period of delay he had in his mind, for he does not indicate at all how many days he would wait. Here is his view :

"In general, surgeons have not endeavoured to delay it (amputation) till the patient had been housed and put in the way of cure; and therefore it has been a common practice to operate on the field of

battle; nothing can be more improper than this practice, for the following reasons. In such a situation it is almost impossible for a surgeon in many instances to make himself sufficiently master of the case, so as to perform so capital an operation with propriety; and it admits of dispute whether, at any time and at any place, amputation should be performed before the first inflammation is over."

Again: "The only thing that can be said in favour of amputation on the field of battle is that the patient may be moved with more ease without a limb than with a shattered one, but it may be observed that there will be little occasion to amputate an upper extremity in the field, because there will be less danger in moving such a patient than if the injury had happened to the lower."

There is no doubt that modern surgeons would not agree that obviously necessary amputations should be delayed for several days, and would advocate their performance as soon as the condition of the patient permitted it. But we must remember that in the year 1760 methods of averting hæmorrhage were very primitive, and that severe loss of blood from an operation which followed soon after the primary hæmorrhage due to the injury might well prove fatal, when delay might have lessened the risk.

GUTHRIE'S ADVOCACY OF PRIMARY AMPUTATION.

In 1815 Guthrie published his book on 'Gunshot Wounds of the Extremities Requiring the Different

Operations of Amputation,' and in it he strongly defended primary amputations and opposed with excellent reason the advice given by Hunter. In this he was certainly in the right, and largely because his opinions were founded on a very extensive experience.

Guthrie at the time I allude to was very young in years, for he was only aged sixteen when he joined the Army in 1801 as assistant surgeon. But the time he had spent in the Peninsular War had been a time of constant fighting, and his talents and skill had quickly earned for him a most responsible position in which he had opportunity for much operative surgery.

I therefore desire to direct your attention to the results which he quotes in support of his own views and in opposition to the advice of Hunter. These relate to (A) primary operations on the field of battle (Toulouse); (B) secondary operations in general hospitals (Toulouse).

	(A) Primary amputations.			(B) Secondary amputations.		
	Total.	Died.	Cured.	Total.	Died.	Cured.
Upper extremities	7 ...	1 ...	6 ...	15 ...	3 ...	12
Lower extremities	40 ...	8 ...	32 ...	36 ...	18 ...	18
Total	... 47	9(19%)	38	51	21(41%)	30

To these figures Guthrie supplies the comment :
 "The medical duties both in the field on the day of action and in the hospitals afterwards until the final evacuation of Toulouse were more immediately under my observation and control"; so that it is clear that the figures given represent the final results.

But I do not quote these figures merely for the purpose of showing that the practice of primary amputation was to be preferred to that of secondary, but also to draw attention to the fact that these results of primary amputation must be considered very good, and to ask the question how it was that these patients did so well.

No doubt one very important reason was that at the end of the Peninsular War surgeons had become very expert in the act of removing a limb, for the amputation rate was exceedingly high, and in the battle of Toulouse itself no less than 98 patients lost a limb out of a total of 1407 wounded, or about 1 in every 15.

It must also be remembered that in many patients the injury which justified amputation in those days was not necessarily so severe as to induce a serious condition of shock, for many amputations were done not so much because of the serious condition of the limb at the moment as on account of the complications which could by experience be foretold. Thus, it was well known that in few patients with fracture of the femur could life or a useful limb be saved, and all wounds of the knee-joint complicated by any fracture were also treated by amputation—conditions for which in the present war we should very rarely advise removal of the limb unless there were serious complications.

But although Hunter's advice to wait for amputation until "the first inflammation is over" was not accepted by his successors, it must be noted that

we do not ourselves advocate operation "on the battlefield," nor should we in these days be satisfied as easily as Guthrie, who says :

"The military surgeon should never be taught to expect any convenience ; his field-pannier for a seat for the patient and a dry piece of ground to spread his dressings and instruments upon are all that are required."

We should further note that Hunter himself advocates removal of a limb at once "if the parts are very much torn so that the limb only hangs by a small connection," and also that "it may be necessary to perform the operation to get at blood-vessels which may be bleeding too freely."

PRIMARY AMPUTATIONS AT THE PRESENT DAY.

Let me ask you to consider the treatment of gunshot wounds by primary amputation at the present day.

In the first place, many surgeons besides myself have always advised that a completely shattered limb should be removed as soon as the patient can be brought into a field ambulance, unless his condition is such as to prohibit any operative treatment at all. There is no doubt in the minds of careful observers that the keeping of such a limb, even for a short time, is most prejudicial to the patient, probably to some extent because of the absorption of toxins from the smashed muscles, and that as soon as he is rid of it his condition improves.

In proportion as shock is severe and the limb is nearly severed, it is not, however, advisable to do at once a formal amputation above the seat of injury—especially if the lower extremity be the one concerned—and it is enough at the moment to sever the remaining tissues with knife or scissors, to tie bleeding vessels, apply a dressing, and then to leave the patient to improve before more is done. This severance of the remaining tissues of the limb requires no anæsthetic save a small dose of morphia and the tight application of a tourniquet, for the latter causes so much numbness that no pain is felt from the procedure I have advocated.

It is specially inadvisable to give chloroform or ether if the conditions require the early evacuation of the patient or if a formal operation under an anæsthetic is shortly to be performed. A second administration of these anæsthetics after an interval of only a few hours has proved most harmful in such patients, and should certainly be avoided.

In other cases where the limb is not completely shattered but yet requires removal, it is generally best to splint it carefully and to send the patient to a casualty clearing station, where he can be put to rest in a warm place and be carefully tended till he has recovered from the effects of the journey and has taken plenty of fluid and has slept. After that there is generally no object in further delay, but in many cases it is necessary, in order to get the patient into an “operable” condition, to administer fluid of some kind either *per rectum* or by intravenous injection. For the latter purpose we have used with

good results a 6 per cent. solution of gum arabic, or, if the loss of blood has been excessive, a pint or more of blood has been transfused, and by these means many lives have been saved.

I have already mentioned the inadvisability of two administrations of ether or chloroform, but where a patient is suffering from severe shock or hæmorrhage even a single anæsthetisation by either of these is very definitely dangerous, and may be quite enough to turn the scale in the wrong direction and prevent recovery.

I believe that in such cases as we are considering it is safer to give no anæsthetic than to give chloroform, and ether is not much better. Far the best method of anæsthesia is the administration of gas and oxygen, and amputations may often be performed when the patient is under the influence of this anæsthetic which could not be done at all without it.

I am indeed inclined to believe that the success in primary amputations of Guthrie and his contemporaries would have been diminished if chloroform could have been given, and I am quite convinced that it should never be employed in such cases.

During the present war we have gradually but steadily so improved our methods of treatment of men with severe shock caused by smashed limbs that we are now able to save patients by amputation of an extremity who would previously have died without operation being possible. On the other hand, we are also able to save very many limbs which would

four years ago have been lost. Whereas in our longest established general hospitals about one patient in every 100 wounded men lost a limb in 1914-15, in the same hospitals during the past year amputations have been performed in only about one patient out of every 200.

GAS GANGRENE.

It is a curious fact that Hunter has practically nothing to say of the complications of gunshot wounds, and it is evident that those he saw left but little impression on him. In the present war the frequency of "gas gangrene" has greatly impressed all surgeons, for in civil practice it was practically unknown, and its frequency came as a rude shock to the aseptically trained operator. But if it be asked, "Did gas gangrene occur as a common complication in Hunter's time, and has it been of frequent occurrence in other wars?" I believe that the reply should be in the negative. My own belief is that in no previous wars has gas gangrene ever played so predominant a part as it has in France and Belgium in the early part of this war.

It must be admitted by all that acute gas gangrene is so striking and terrible a malady that it could not possibly have been overlooked if it were at all frequent. Yet I find no description of it in Hunter's work or in those of any of the early writers on war surgery, and although the latter wrote chapters on the subject of gangrene or "mortification," it is evident that they refer to that which is

due to vascular lesions or else to an extensive smashing of a limb followed by sepsis.

It is certain that the so-called "hospital gangrene," so fully described by Larrey as "*pourriture des hôpitaux*," was not gas gangrene, but a spreading septic ulceration which characteristically did not occur soon after injury, but rather in suppurating wounds, and was of the same nature as the "sloughing-phagedæna" which not so many years ago was rife in wards for venereal diseases. And Larrey's contemporary in the French Army, Baron Percy, and Guthrie in the British Army, give no description of a disease occurring in the Peninsular War resembling the gas gangrene of the present day.

There is no mention of its occurrence, and still less of its prevalence, in the Crimean War; while Professor W. W. Keen, who himself served in the American War, writes to-day: "Personally I never saw a single case in the Civil War."

Various French writers described cases of gas gangrene in the Franco-German War of 1870, but, although there is no doubt of its occurrence at that time, there is no evidence that it was generally prevalent.

Coming to still more recent times, gas gangrene never occurred in the South African campaign, and was of quite rare occurrence in the Russo-Japanese War. Finally, I have personally inquired of many surgeons who took part in the Balkan War of 1913, and there is no doubt in their minds that it was very seldom seen.

In the present war gas gangrene has been practically unknown in Mesopotamia, Egypt, or Palestine, and I am informed that it did not occur in the early days of fighting at Gallipoli, although it was occasionally seen later on. At the Salonika front it has been of comparatively rare occurrence, and it has not been nearly so prevalent on the Italian front as in Flanders.

INCIDENCE OF GAS GANGRENE.

It is well known that at the beginning of the war in France and Belgium the medical services of all the combatants were quite inadequate to deal thoroughly with the immense number of wounded. Most of the latter at the time of the retreat from Mons and in the fighting on the Aisne had to be evacuated to base hospitals before any thorough surgical treatment could be carried out. There were practically no "hospital trains" in those days, and the railway services were so crowded with supplies for the armies that traffic of all kinds was excessively slow. The result was that the wounded, placed when opportunity offered in the luggage-vans of empty returning supply-trains, were frequently several days in reaching their destination after being wounded, and great numbers of them were suffering from extensive gas gangrene on arrival, or else had succumbed to it *en route*.

During the ensuing "First Battle of Ypres" and the succeeding winter it was still an exceedingly frequent complication, but diminished very much

during the next summer, when there was also much less fighting, until the battle of Loos in September, and during this battle it was much increased. In 1916 it was less evident until the heavy casualties of the battle of the Somme filled the hospitals with wounded, many of whom developed gangrene; and during the fighting at Arras and Vimy in the cold and stormy spring of 1917 there were still very many cases, in spite of good surgical work at the front. From that time, now nearly two years ago, gas gangrene has rapidly diminished, and during the year 1918 it has been comparatively little in evidence, at any rate in its worst forms, as will be gathered from the following samples of figures from the base hospitals during heavy fighting.

“A. Of 5270 consecutive patients from the Messines battle (in June, 1917) there were only 22 cases of gas gangrene.

“B. Of 3690 consecutive wounded at the beginning of the Passchendaele fight (in August, 1917) there were only 16 cases of gas gangrene.

“C. Of 3200 at a later stage of the same fight 7 cases.

“D. Of 2900 patients in July, 1918, there were 11 cases of gas gangrene.

“E. Of 10,000 wounded in August, 1918, there were 27 cases.”

It will therefore be seen that out of a total of about 25,000 patients at base hospitals only 83 patients had serious, or “massive,” gas gangrene—an incidence of about 1 case in 300 wounded men,

and many of these had multiple wounds or badly-smashed limbs.

CAUSES OF LESSENERED INCIDENCE OF GAS GANGRENE.

If the question is now asked as to what causes account for the great diminution of this grave affection in 1917-18, it must first of all be noted that :

(a) The ascertained cause of gas gangrene is the presence of certain well-recognised anaërobic organisms which are present in highly dunged and cultivated soil, and are absent from that of the South African veld or the sun-dried sand of Egypt and Palestine, while they are present in small numbers and are apparently less virulent in Eastern Europe.

(b) The organisms concerned have little power over healthy tissues, but they are resistant to the strongest antiseptics and grow freely in damaged muscle, especially if into the latter be thrust some foreign body rich with the organisms, such as a piece of shell or muddy clothing. Some of the very worst cases are those where the "missile" is composed only of the mud itself which is driven with immense force by a shell or bomb exploding in muddy ground, and frequently causes a great number of small wounds, in some of which the mud may be driven right through the deep fascia or actually into the muscle sheaths.

(c) Lowered vitality of the patient by exposure

to wet and cold, and exhaustion from want of food, and over-exertion, are predisposing causes, as is also to a very serious extent the deprivation of blood-supply, owing to injury of a large vessel. It is also clear that wet and cold weather and mud favour gas gangrene much more than heat and dust.

Such are the now well-recognised causes of gas gangrene and the conditions in which it may be expected to occur, and very much of the reduction now noticed is due to the abandonment of faith in strong antiseptics, and to the timely excision and surgical cleansing of the wound and the removal of all foreign bodies. It may also be claimed that the thorough arrangements for the treatment of the chilled and exhausted man by warmth, rest and intravenous injections have saved many lives through restoring the vitality and resisting powers of the patients.

INFLUENCE OF CHANGED CONDITION OF SOIL.

But, when all this is allowed for, it is evident that there must have been other causes at work to account for so great a diminution of this danger to the wounded man, and these must be sought in a lessened virulence of the infecting agent itself which has occurred during the past four years, and has, in its turn, resulted from altered conditions of the soil in which the organisms are bred. That this is true is supported by the following facts :

In the Somme battle of 1916, in spite of many

thousand operations performed at the Front, there were very numerous cases of bad gas gangrene both in the casualty clearing stations and at the base hospitals, although they were much less frequent than in 1914. In the Somme fighting over the very same ground, during the retreat in March, 1918, when the casualty clearing stations had to be abandoned, operations could not be done at the Front. Patients had consequently to be sent to the base in trains of all kinds as well as in ambulance trains, and were often not thoroughly treated by surgical operation till after a delay of one or two days. Yet there were far fewer cases of gas gangrene in 1918 than in 1916, and in 20,000 patients at one base between March 23rd and 29th, during the worst period of the retreat, the incidence was only 1 per cent.

But, whereas in the earlier years of the war much of the land was covered with rich crops and had recently been very freely manured, at the present time in the battle areas the face of the earth is absolutely changed. A great stretch of country, comprising many hundreds of square miles, has been practically destroyed, as far as its development by mankind is concerned. What was once a prosperous country-side with highly cultivated arable land is now little more than a desert, pitted with shell-holes, scarred by innumerable trenches and gunpits, the chalk subsoil scattered over the surface of the ground, the skeletons of smashed and shredded trees alone marking the sites of destroyed villages, and all appearance of cultivation wiped

out. The whole land has gone back to "prairie conditions," and looks like an extensive and barren moor, although in summer time it is partly redeemed by the luxuriant growth of wild flowers.

In such a country, which has been exposed to sun, wind and rain for three or four years, uncultivated, unmanured, uncropped, deserted by man and animals, it is probable that the anaërobic organisms have diminished both in numbers and virulence.

But, be the causes what they may, it was an immense relief to the surgeon in 1917-18 to find that this, the greatest surgical epidemic of wound infection which has ever been recorded, was neither so prevalent nor so dangerous as formerly, and that the wounded man was no longer so greatly exposed to grave risk of life or limb, even though his wound itself were slight and involved no vital part.

TRANSPORT AND HOSPITALS AT THE FRONT.

I now turn to the arrangements for transporting and treating wounded men.

EVOLUTION OF THE FIELD AMBULANCE.

The history of the early hospitals in the British Army has been carefully investigated by the late Colonel William Johnston, and from his researches it appears that in Hunter's day the patients at the front were treated in "regimental hospitals" or else in "garrison hospitals." "Marching" hospitals or "flying" hospitals were established by William III, and first saw active service in his campaign in

Ireland. In addition to medical *personnel* they had "nurses, cars for the transport of the sick, drivers, and men-servants." Unfortunately these precursors of our present field ambulances came to end with the completion of Marlborough's campaigns in 1711, and were not revived until the nineteenth century, so that they did not exist in Hunter's time.

Ranby wrote in 1781 as follows: "I would wish to be indulged in a scheme which might, I think, be put into execution with all the facility imaginable. It is this, when the Army is forming for an engagement let the surgeons with their respective mates of the three or four regiments that are posted next to each other collect themselves into a body and take their station in the rear according to the command of the general. Here let the wounded be put under their immediate care and management. By this means they will be enabled mutually to assist each other and to perform their duty both with care, exactness, and dispatch."

It is thus evident both that the need of some arrangement for mutual aid was felt and also that it did not exist in Hunter's time.

In those days the wounded soldiers were taken to the base in country wagons or in the regimental forage carts, and it was left to Larrey to create in 1792 the first "ambulance cars," which were reserved for the sole use of the sick and wounded, and which were named by him "Ambulances Volantes." He figures and describes them as "a kind of carriage hung on springs, uniting great strength and solidity."

They were of two kinds—the light with two wheels and the heavy with four wheels. Each ambulance “cadre” or “division” was provided with twelve light and four heavy cars, and comprised a *personnel* of 340 officers and men. Larrey states that after the battle of Eylau in 1807 the wounded were successfully transported by the *ambulances volantes* to châteaux “at a distance of not less than fifty-five leagues.”

This “division” may fairly be claimed as the first efficient field ambulance in the history of war. Since this period horsed ambulances of various types have been employed as part of the transport of our own field ambulances, but it was not until the present war that “motor ambulances” were added to the transport of the field ambulances and that “motor ambulance convoys” were provided to supplement the latter. I think it is hardly realised how much in present warfare the whole system of the treatment of the wounded is based upon and pivots on the “motor ambulances.”

INFLUENCE OF INCREASED RANGE OF PROJECTILES.

In Hunter's time the range of the musket was two or three hundred yards and that of a cannon less than a mile; beyond this distance surgeons could work in safety. It was consequently not at all difficult to carry the wounded man to some place where a barn, or shed, or a stone wall offered sufficient protection, for there were no shells.

At the present day there is no such thing as absolute safety anywhere near a battle front. Apart from bombs and from guns of exceptional range, immense numbers of shells are fired to a distance of from six to eight miles. The consequence is that, while surgeons supply skilled help, at much risk, at the regimental aid-post or the advanced dressing-station, within a very short distance from the line, the patients have to be removed quickly to considerable distances, and the casualty clearing stations have to be placed some eight miles or more in the rear. The consequence is that horsed vehicles could not possibly make a sufficient number of journeys to bring in the wounded from heavy fighting within a reasonable time, and in addition, the numbers of the wounded are so great that there has been nothing in any previous war to compare with the task of the ambulances of the present day.

It must therefore be understood that all wounded men have now to be taken a considerable distance before reaching a place where they can be both immediately treated by the surgeons and also retained and cared for after operation. It is during this long motor-car journey from the battle-front that the patient runs risks of those further injuries which it is the object of the surgeon to minimise as much as possible.

CARE OF WOUNDED DURING REMOVAL.

One of these risks is exposure to cold.

This is a most serious danger to men suffering

from shock or hæmorrhage. To avoid this hot-water bottles are freely used, stretchers are covered with one folded blanket, and the patient is warmly wrapped in others. The car is also usually provided with a pipe heated by a supply of hot air from the exhaust pipe of the engine.

The other most important risk is that of injury to the soft tissues by the fragments of broken bones which are jolted by the movements of the car.

The extent of this will largely depend on the roughness of the road and its pitting by shells, but to a still greater extent it will depend on the care with which suitable splints are applied. It is the custom in the British Army to splint all fractures as far forward as possible, and in any case at the field ambulance, with the result that, with the apparatus now provided, fractures are so immobilised that the minimum of risk is incurred and the minimum of pain is caused by the journey. It is not too much to say that very many patients who, without a good splint, would arrive in a state of collapse and die, or else would lose their limbs, now get down to the casualty clearing station with discomfort rather than with suffering.

It has been remarked that the modern offensive methods which characterise this war are largely dependent on the invention and development of the petrol engine, and that the tractors of great guns, the war in the air and the war under the sea are all dependent on this device. It is at least some satisfaction to know that it is to the same device

that tens of thousands of wounded men owe, not only a more comfortable transport than the soldiers of previous wars, but also the saving of lives and limbs in numbers beyond measure.

THE CASUALTY CLEARING STATION.

In Hunter's day the only hospitals near the front seem to have been those called "regimental," and they were apparently established in any buildings which seemed suitable for the purpose. I have not found any records of their equipment, the number of their *personnel*, or their accommodation. It is probable that they were very primitive.

In our own Army at the present day the demand for hospitals at the Front has resulted in a new unit which has been created by the conditions peculiar to this war. I allude to the casualty clearing stations, and these have their counterparts in the armies of other European combatants.

GREAT DEVELOPMENT IN WORK OF CASUALTY CLEARING STATION.

This unit had not been in action before the present war. At the commencement of hostilities it consisted of a staff of six medical officers with a commanding officer and quartermaster and eighty orderlies; some of the latter were well-trained nurses. It provided accommodation for 200 patients on stretchers, but was not supplied with beds. Its surgical equipment consisted merely of sufficient instruments and appliances for the performance of

a few urgent operations, and it was provided with one operating table and a few very primitive wooden splints. Its function, as the name implies, was to "clear" the field ambulances and to pass on by train the sick and wounded for further treatment at the base hospitals. Each unit was intended to be attached to a division and was supplied with horsed transport.

Since those days the long line of trenches and the comparative immobility of the armies until recently have provided the opportunity for very great developments, with the result that the casualty clearing stations of the present day are very efficient and well-equipped advanced hospitals, with theatres for six or more tables, and suitable in every way for the performance of any operation. They have been expanded to provide, according to circumstances, for from 600 to 1200 patients, of whom 200 have beds and the remainder stretchers.

A great deal might be said of the work of the casualty clearing stations which would be out of place here, but it may be pointed out that an advanced hospital of this type is an absolute necessity in the warfare of the present day. Very little experience was required to show that it was quite impossible to carry out the pre-war idea of doing all the surgery (with few exceptions) at the general hospitals at the base. Men with such injuries as wounds of the chest and abdomen, severe fractures, and wounds of large vessels, could not be safely conveyed long distances by trains, while patients suffering from dangerous shock or the

effects of profuse hæmorrhage demanded immediate treatment as near the front as possible. But, over and above all these, the necessity which arose for early operation in order to prevent the development and spread of gas gangrene or dangerous sepsis in even slight wounds alone justified the expansion of the casualty clearing stations.

THE SURGERY CARRIED OUT AT CASUALTY CLEARING STATIONS.

It will thus be seen that the object in view in their development was to secure efficient treatment as early as possible. The ideal of surgical treatment would be the supply of enough surgeons and enough hospitals close to the front to allow of all operations being always performed there with the least possible delay. This ideal has, indeed, been often realised in the present war, when, during quiet periods, the wounded were comparatively few, but it has proved impossible to supply enough surgeons and enough accommodation to realise the ideal when the casualties of a great battle number many thousands a day, and when the duration of the battle is measured not by days but by weeks or months. But, although it has not been always possible to do that which is ideal, the custom of reinforcing busy hospitals with "teams" of extra surgeons, anæsthetists and assistants has enabled an immense amount of work to be done.

Apart from operations on the abdomen, the chest, and the head, the vast bulk of this work is of a

nature which appeals to surgeons and to patients alike, for it is "conservative surgery" in the best sense of the term. In the first place it consists largely in the thorough surgical cleansing of wounds so as to save limbs and lives, and in the second place it supplies the necessary foundation for the early closure of the wounds by suture. In this way large flesh wounds are prevented from suppurating, "compound" fractures are made "simple" fractures, and the patient is saved from a long illness and its debilitating effects. Such treatment diminishes stay in hospital, frees hospital beds, lessens the labour of nurses and surgeons, and, best of all from the point of view of the Army, it enables many patients to recover quickly and to return to their regiments.

I would claim that, apart altogether from considerations of humanity, good front-line surgery very fully compensates an army for the demands it necessarily makes on supply and transport. It more than pays its way both by returning sound combatants to the ranks, and also by saving the country the expense of innumerable pensions on behalf of men whose lives or limbs have been saved.

VALUE OF FRONT-LINE SURGERY TO THE ARMY.

Long before this war the combatant branches of the Army fully realised the importance of the prevention and cure of illness and their effects on the maintenance of armies in the field, but it is only during the present war that the value of good and prompt surgery has been fully appreciated and that

the necessary facilities have been supplied whenever the military situation has permitted. Similar facilities will henceforth be expected in all future wars.

It is well known to the medical profession that an immense amount of this front-line surgery has been successfully undertaken, and it is also well known to, and deeply appreciated by, the combatants of all ranks, whose confidence and faith in the Army Medical Service is by far the best possible tribute that could be paid to it. I will not attempt to supply any statistics, but some idea of the magnitude of the surgical work at the front will be gathered if I state that during the three and a half months of the Third Battle of Ypres in 1917, 61,500 operations were performed under anæsthetics in the casualty clearing stations of two armies.

ORGANISATION: ADAPTATION TO WAR OF MOVEMENT.

It will easily be realised that much forethought and preparation are required to produce these results, for they require not only arduous work by day and night for, perhaps, twelve hours out of twenty-four—a tax on the strongest when continued for weeks on end—but also the harmonious working from the front to the rear of stretcher-bearers, regimental medical officers, field ambulances, ambulance convoys, and ambulance trains, any one of which is liable to interruption by accident or by the acts of the enemy.

The staffing of the casualty clearing stations for the Third Battle of Ypres especially deserves to be

recorded, for on this occasion many of the best known and most representative surgeons from the United States, from Canada, Australia, New Zealand and South Africa were included in the reinforcing surgical "teams," or else were on the staffs of the casualty clearing stations of the armies concerned. Thus, for the first time in history, the surgical skill and talent of all the various sections of the Anglo-Saxon race were brought together on a battle-field, and with the happiest possible results to the wounded men. On this occasion, because of the absence of heavy fighting in other armies, more surgeons were available than at any other period, and no clearing station had less than twenty-four surgeons and twenty-four nurses. It was therefore possible to keep eight operating tables in action in every unit, and there is no doubt that almost every wounded man whose condition made it advisable was passed through the operating theatre before being sent by ambulance train to the base.

The war of movement which characterised the closing stages of the campaign called for the development of new methods of meeting the situation thus created. Of the details of these a great deal might be written which would be too lengthy for the present occasion, but this much may be said. The clearing stations were sufficiently reduced in the bulk of their equipment to enable them to be rapidly moved forward, and they were frequently able to take in and treat many hundreds of men within twenty-four hours of their arrival on a new site, while at no time during the whole campaign was there more

work done in resuscitating the badly wounded and in the intravenous administration of blood or of alternative fluids to men who had suffered from severe hæmorrhage.

CONCLUSION.

And now let me recall to your attention a phrase of Hunter's which I read to you at the beginning of this address.

“It [the appointment of the Belleisle Expedition] drew my attention to inflammation in general, and enabled me to make observations which have formed the basis of the present treatise.”

The war was to him not merely a sphere for the exercise of his surgical skill, but also an opportunity for observing and studying conditions of which he had hitherto had no experience. What has this war been to the surgeons of the present day? It may truly be said that very many of them, and in all parts of the world, have entered into this work imbued with the spirit of our great master. To them it has not only afforded immense opportunities of helping their fellow countrymen, but has also provided problems for study and for solution.

The spirit has been one of progress, and of development and unwillingness to rest content with conditions that might be bettered or with methods which proved unsuitable. It is not too much to claim that each year of war has seen better surgical measures devised and consequently better results obtained. The sufferings of the wounded have

been lessened, the dangers they run have been diminished, and lives and useful limbs have been saved in constantly increasing numbers. Surgeons have not been content merely to guess at possible answers to the never-ending questions suggested by the complications of war. They have devised new methods to meet new conditions, and have put them to the test of experience, and when they have failed they have tried and tried again until they have compelled success.

In this great tragedy of war the Royal College of Surgeons of England has played no unimportant part. Hundreds of its Fellows and thousands of its Members have willingly pressed forward for service. Some of them, like our President, have occupied with credit and honour the most prominent and important positions, and others of them, often less prominent no doubt, have not only given their services, but have also given their lives. The position I have had the honour to hold in the Army Medical Service has afforded me very abundant opportunities of appraising the work of others, and I am full of admiration both for the skill and ability of our surgeons, and for the splendid performance of the Royal Army Medical Corps in rescuing the wounded in conditions of unpredecented difficulty and danger, and in organising the hospitals for the subsequent treatment and restoration to health of the British soldier.

